

CLAIMS

We claim:

5 1. A microfluidic device including a channel therethrough having upstream and downstream ends and being adapted for receiving a vesicle, the vesicle containing predetermined cargo therein and having an outer surface carrying a bioactive molecule, the microfluidic device comprising:

 a suspension structure positioned within the channel for retaining the vesicle at a
10 selected location within the channel; and

 a detection structure positioned in the channel downstream of the suspension structure, the detection structure providing a reaction in response to exposure to the cargo.

15 2. The microfluidic device of claim 1 wherein the detection structure includes a first post that dissolves in response to exposure to the cargo.

 3. The microfluidic device of claim 2 wherein the detection structure display includes a second post that is non-responsive to exposure to the cargo.

20 4. The microfluidic device of claim 2 wherein the first post is formed from polyacrylamide and dissolvable disulfide crosslinkers.

 5. The microfluidic device of claim 1 further comprising a reagent receivable
25 in the channel, the reagent flowable from the upstream end to the downstream end of the channel.

 6. The microfluidic device of claim 1 wherein the reagent includes
30 predetermined stimuli therein, the predetermined stimuli reacting with the bioactive molecule to free the cargo from the vesicle.

7. The microfluidic device of claim 1 wherein the suspension structure includes a filter having a predetermined pore size, the pore size being of a dimension that prevents the vesicle from flowing downstream of the filter and that allows the cargo to flow downstream through the filter.

5

8. A method of relaying and amplifying an initial biochemical signal in a microfluidic device, comprising the steps of:

encapsulating cargo within a vesicle, the vesicle having an outer surface;

5 implanting a bioactive molecule in the outer surface of the vesicle;

exposing the vesicle to a reagent;

releasing the cargo from the vesicle in response to predetermined stimuli in the reagent; and

generating a reaction display in response to the release of the cargo.

10

9. The method of claim 8 comprising the additional step of providing a microfluidic device having a channel therein and wherein the step of exposing the vesicle to the reagent occurs in the channel of the microfluidic device.

15 10. The method of claim 8 comprising the additional step of passing the cargo through a filter.

11. The method of claim 10 comprising the additional step of positioning the filter in the channel for capturing the vesicle upstream thereof.

20

12. The method of claim 11 wherein the step of generating a reaction includes the step of positioning a visual display in the channel downstream of the filter.

13. The method of claim 12 wherein the visual display includes a responsive
25 post that dissolves in response to exposure to the cargo.

14. The method of claim 13 wherein the step of generating a reaction includes the additional step of dissolving the responsive post.

15. The method of claim 13 wherein the visual display includes a non-responsive post having a configuration, the configuration of the non-responsive post maintained in response to exposure to the cargo.

5 16. The method of claim 8 wherein the vesicle is a liposome.

17. The method of claim 8 wherein the bioactive molecule is an antigen.

18. The method of claim 8 wherein the predetermined stimuli include an
10 antibody and a set of proteins.

19. A method of relaying and amplifying an initial biochemical signal in a microfluidic device, comprising the steps of:

positioning a vesicle in the upstream end of the channel, the vesicle containing predetermined cargo therein and having an outer surface carrying a bioactive molecule;

5 exposing the vesicle to a reagent;

releasing the cargo from the vesicle in response to predetermined stimuli in the reagent binding to the bioactive molecule; and

generating a reaction in the channel downstream of the vesicle in response to the release of the cargo.

10

20. The method of claim 19 comprising the additional step of positioning a filter in the channel for capturing the vesicle upstream thereof.

21. The method of claim 20 wherein the step of generating a reaction includes
15 the additional step of positioning a visual display in the channel downstream of the filter.

22. The method of claim 21 wherein the visual display includes a responsive post that dissolves in response to exposure to the cargo.

20 23. The method of claim 22 wherein the step of generating a reaction includes the additional step of dissolving the responsive post.

24. The method of claim 23 wherein the visual display includes a non-responsive post having a configuration, the configuration of the non-responsive post
25 maintained in response to exposure to the cargo.

25. The method of claim 19 wherein the vesicle is a liposome.

26. The method of claim 19 wherein the bioactive molecule is an antigen.

30

27. The method of claim 19 wherein the predetermined stimuli include an antibody and a set of proteins.